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ABSTRACT

Text, illustrations, and exercises are utilized in this set of four learning modules to instruct medical technology students in a variety of job-related skills. The first module, "EEG Technology: Measurement Technique of the 'International 10-20 System'" by Dorothea Brittenham, describes a procedure used by electroencephalograph technicians to locate positions on the patient's scalp where electrodes should be placed. The second module, "Low-Frequency Filtering on the EEG" by Edith McTiernan, details the operation and effects of low-frequency filters on electroencephalographs. The third module, "Right Lateral Decubitus Position--What View Is It?" by Mary G. Watts, teaches radiologic technology students to interpret and recognize gall bladder X-rays taken with the patient lying on his/her right side. The fourth module, "Close-Up Photography Using Extension Tubes" by Stephen K. Peltz, instructs biomedical photography students in securing extension tubes to single lens reflex cameras and in calculating exposure in close-up photography. Each of the illustrated modules provides sequential reinforcement exercises, describes procedures, and concludes with a post-test and an accompanying answer key. The modules are designed to be completed in a specified amount of time ranging from 20 to 30 minutes each. (JP)

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ED202552

HEALTH INSTRUCTION PACKAGES:

Medical Technologies -- EEG, Radiology, & Biomedial Photography

Modules prepared by:

Dorothea Brittenham, R. EEG T.
Edith McTiernan
Mary G. Watts
Stephen K. Peltz

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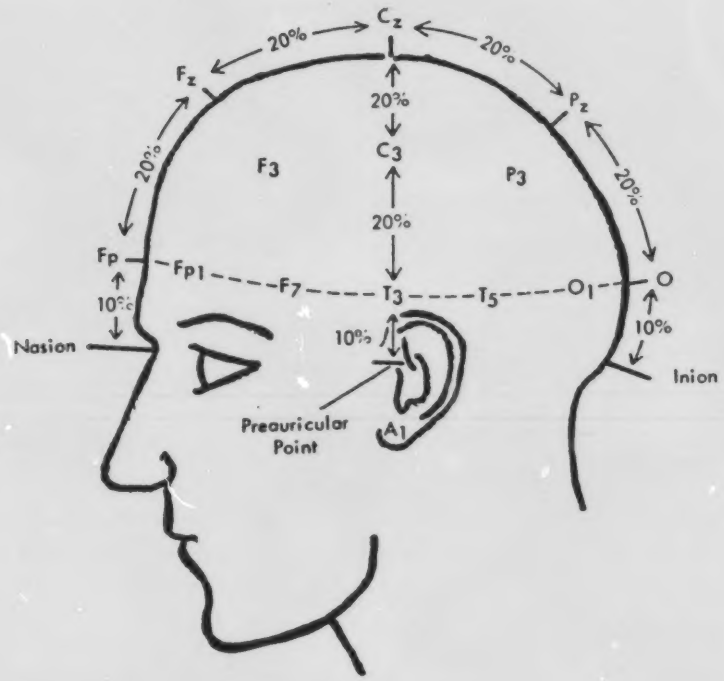
MEASUREMENT TECHNIQUE OF THE "INTERNATIONAL 10-20 SYSTEM" - EEG TECHNOLOGY

by

Dorothea Brittenham, R. EEG T.



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TITLE:	Measurement Technique of the International 10-20 System
AUTHOR:	Dorothea Brittenham, R.EEGT.
INSTITUTION:	St. Joseph's Hospital
INTENDED STUDENTS	EEG technology
ESTIMATED WORKING TIME:	40 minutes
MATERIALS NEEDED:	Model of skull; metric measurement tape; blue marking pencil

FIELD TEST COPY

NOTE:
Use of this unit will be more effective if students work as partners.
Knowledge of the metric scale is prerequisite to use of the unit.

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OBJECTIVES OF UNIT

Overall Objective

The student will accurately measure the patient's head according to the specified criteria of the "International 10-20 System", and will identify specific measurement points on the head.

Sub-Objectives

locate landmarks on patient's head

measure distances between landmarks

divide distances into 10 and 20% segments

establish measurement points on head

list the measurement points by prescribed letters

obtain accuracy and symmetry of measurement points of no more than .5 cm.

Attitudinal Objective:

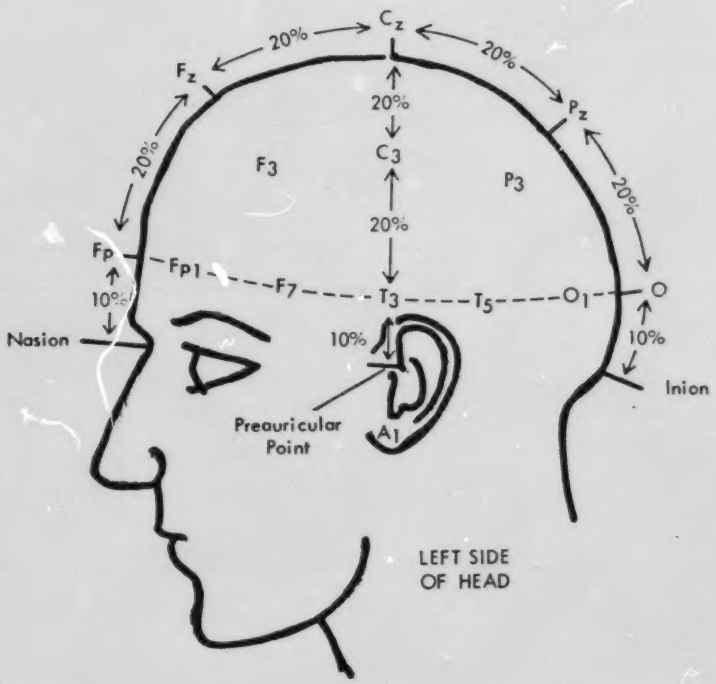
The students will cooperate by volunteering for each other, by assisting for and sharing with one another.

INTRODUCTION

The "International 10-20 System" of Electrode placement is a procedure for the measures location of equally spaced electrode positions on the scalp, using identifiable skull landmarks as reference points.

Skill and accuracy in establishing measured points are achieved by careful adherence to sequential procedure. A technique is described for assisting the student in a group setting by role playing and for increase in value contribution by practice on other students.

This diagram may not make much sense at this point, but take a good look at it. You will keep referring back to it to understand specific points as you work through this unit.



IN THE 10 - 20 SYSTEM, ELECTRODES ARE PLACED EITHER 10% OR 20% OF THE TOTAL DISTANCE BETWEEN SKULL LANDMARKS

PRACTICE EXERCISE 1

There are four skull landmarks used in the 10-20 system. Remember, they are locations, not measured positions.

The nasion is the indentation between the forehead and the nose.

The inion is a ridge that can be felt as you run your finger up the back of the neck in the skull.

The pre-auricular points are indentations just above the cartilage which covers the external ear opening on the back of the neck.

Practice Question 1

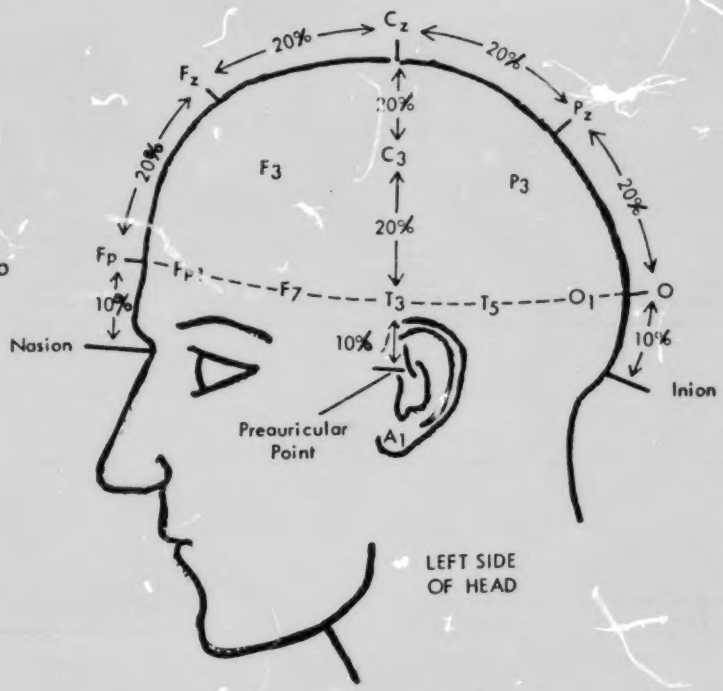
1A. On your partner or yourself, feel for and describe in writing what you encounter before you reach the ridge of the inion.

Answer

You feel a depression just below the protruding ridge of the inion.

Have partner bend his head forward or backward while you find the depression and the ridge again as a final check before you continue on to 1B.

Now locate the nasion and inion on the diagram and study the guide line shown for measurement between the two locations.



18. Using the tape measure, measure on the skull model the distance from nasion to inion and record the measurement in centimeters (cm).

Answer

The distance probably will be an average of 30 cm ± .5 on an adult.

Again, refer to the diagram and locate position Cz, which lies midway between the inion and nasion.

1C. Now, with a tape measure, determine the position Cz on the skull model provided for you. Mark with a pencil on scalp the position of Cz.

Answer

Have another student verify that the distance from the point you marked as Cz to the inion equals the distance from Cz to the nasion.

Remember that the pre-auricular points are indentations just above the cartilage that covers the external ear opening on the back of the neck. Your second measurement is this transverse distance from the left pre-auricular point, through point Cz, to the right pre-auricular point.

1D. On the model, please now locate the pre-auricular points on both ears and measure the distance from the left to the right pre-auricular point.

Answer

Have another student verify that point Cz is halfway between the pre-auricular points as you have measured them.

PRACTICE EXERCISE 2

The sequence of measurements is critical. If the first distances are not measured correctly, the succeeding positions will not be accurate.

Practice Question 2

Describe the sequence in which you did the first two measurements:

1)

2)

Answer

It's essential that you answered:

1) Nasion to inion.

2) Left pre-auricular point to right pre-auricular point.

PRACTICE EXERCISE 3

Now that you have established the landmark locations as well as the reference point Cz, you'll utilize them as bench marks for subsequent measurements.

Look again at the diagram on Page 1 and note that the distance between the nasion and the inion is divided into 10% and 20% segments

Practice Question 3A

1) Divide by 10 the distance you measured between the model's nasion and inion.
2) Measure this 10% figure up from the nasion and mark Point Fp.
3) Measure the 10% up from the inion and mark Point O.

Answer

Have another student verify your math and measurements. If your model measured 30 cm from nasion to inion, the 10% figure would be 3 cm. Point Fp would then be 3 cm above the nasion and Point O would be 3 cm above the inion.

Study the diagram again before you proceed in the sequential manner to subdivide the basic measurement between the pre-auricular points. Note that this distance is also divided into 10% and 20% segments.

3B. 1) Divide by 10 the distance you measured from the left pre-auricular point to the right pre-auricular point

2) Measure this 10% figure up from the left pre-auricular point and mark Point T3.

3) Measure the same 10% up from the right pre-auricular point and mark Point T4.

Answer

Have another student verify your math to reach the 10% figure. Then have him check that you have established points T3 and T4 equidistant and symmetric on both sides of the head.

PRACTICE EXERCISE 4

The position sites for electrodes are labelled in alphabetical letters which are identical in all languages. Therefore, the system is "internationally" used. Points T3 and T4, for example, logically draw their letters from the fact that they are on the skull above the left and right Temporal lobe of the brain.

Practice Question 4

1) List the alphabetical abbreviation of the positions you established at 10% of the distance above the pre-auricular points.
2) These points draw their letters from the fact that they are on the skull above the left and right _____lobe of the brain

Answer

You're right it you said T3 and T4 and that the points are on the skull above the left and right Temporal lobe of the brain.

PRACTICE EXERCISE 5

The system is termed "10-20" because electrodes are spaced either 10% or 20% of the total distance between a given pair of skull landmarks.

Study your diagram once more, noting Points Cz, Fp and O, T3 and T4 all of which you've marked. Note that Points Fz and Pz are equal distance between Fp and Cz and Cz and O, respectively. Similarly, C3 and C4 are equal distance between T3 and Cz and Cz and T4, respectively.

Practice Question 5

Mathematically, how do you determine the distances between the points along the line between nasion and inion and along the line between the pre-auricular points.

Answer

By subdividing total amount of basic measurement between landmark locations into 10% and/or 20% segments.

Remember that arithmetic errors can occur when you are rushed or having an uncooperative patient. You can detect your errors by checking to see that spacing coincides on both sides of the head.

Please do not write on this page - Use Answer Sheet

POST-TEST

1) Locate on diagram the anatomical landmarks and measure the distances on the model using a metric tape.

Nasion

Inion

Pre-auricular point

2) Trace the lines of front to back and side-to-side measurement for bisection of CZ on the model and show these two lines on the diagram.

3) The measurement marks located 10% above the pre-auricular points are labelled with the letters (a) on the left side and with the letters (b) on the right side of the head.

4) Accuracy of measurement is maintained by (circle one)

a) correct subdivision of measurement

b) reference points correspond to landmark locations.

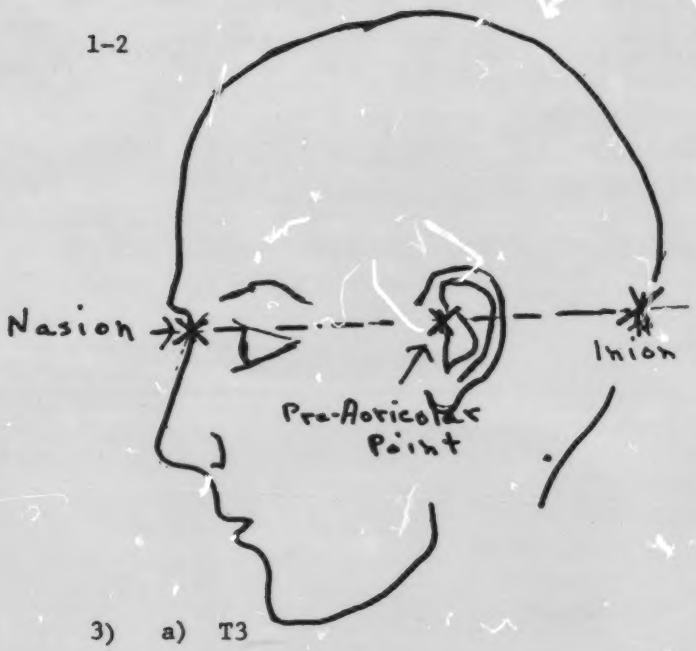
c) each position with a symmetrical counterpart on opposite side of head.

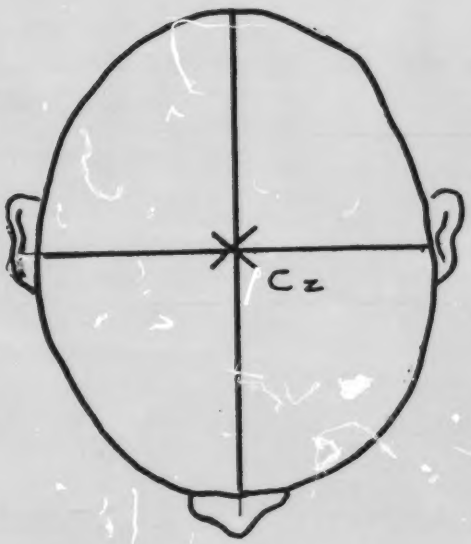
d) none of the above.

e) all of the above.

Post Test Answer Key

1-2





3) a) T3

b) T4

4) e

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LOW-FREQUENCY FILTERING ON THE EEG

PART I

by

Edith McTiernan

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TITLE OF PACKAGE:	Low Frequency Filtering on the EEG - Part I
AUTHOR:	Edith McTiernan
INSTITUTION:	Orange Coast College, Costa Mesa, Calif.
INTENDED STUDENT:	First-year EEG students
ESTIMATED WORKING TIME:	30 minutes
MATERIALS NEEDED:	None

FIELD TEST COPY

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INTRODUCTION

DIALS! DIALS! DIALS!

All over the electroencephalograph -- What do they do? Why are there? What happens when they are switched?

In this unit I hope you will find the answers to some of these questions about just one of the dials -- THE LOW FREQUENCY FILTER.

OVERALL OBJECTIVE:

When you finish this unit you should be able to determine the effect of the low-frequency filter on the electroencephalograph waves.

SUB-OBJECTIVES

1. After completing this unit you should be able to state what part of the EEG wave band is affected by the low-frequency filter.

2. You will be able to describe the cut-off points and the time constant of the low-frequency filters.

3. You will be able to calculate the voltage of the EEG wave after it has been filtered by any of the low-frequency filter settings of the Beckman or Grass electroencephalographs.

Let's begin with one of those many dials on the Electroencephalograph. Take the low-frequency filter. First, what is a filter? Filters are electronic components so arranged that selected frequencies are attenuated (reduced in amplitude) or eliminated entirely from reaching the pens or output of the EEG.

Now, in the low-frequency filter--what band of frequencies does this filter attenuate? This filter attenuates the Direct Current (D.C.) and the Alternating Current (A.C.) waves up to 12 Hertz (Hz) (cycles per second).

The low-frequency filter does not have any effect on waves in the higher frequencies. So you see, the answer to that first question is: the low-frequency filter attenuates D.C. and the A.C. waves from 0 to 12 Hz and does not affect the higher frequencies.

QUESTION: (Encircle the correct letter or letters.)

1. The low-frequency filter affects the:

   a. high-frequency waves

   b. only D.C. frequencies

   c. only A.C. frequencies

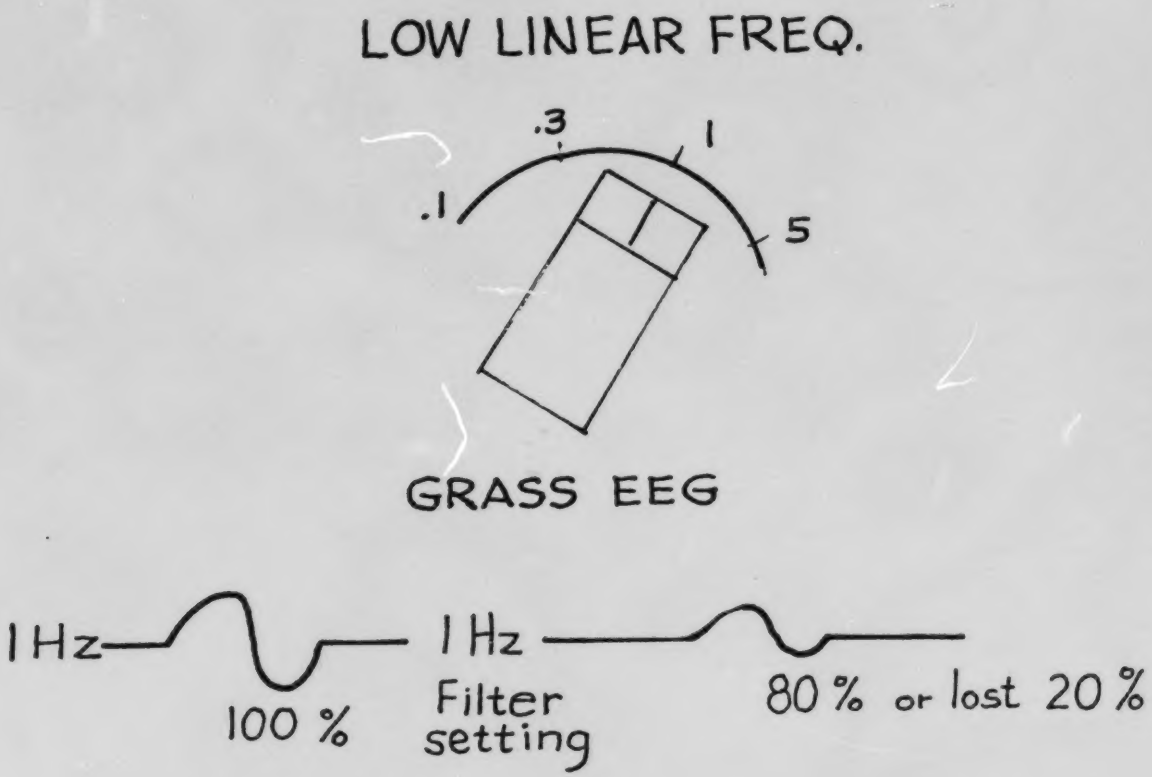
   d. D.C. and A.C. waves from 0 to 12 Hz

The answer is __d__ . D.C. and the band of waves from 0 to 12 Hz are the EEG waves that are attenuated by the low-frequency filter.

The units of the low-frequency filter are:

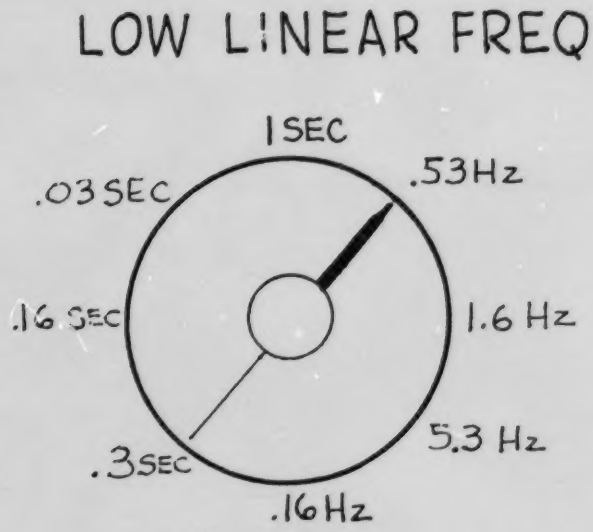
1. Hertz (Hz) (cycles per second) = the cut-off point frequency
2. Seconds - a unit of the time constant.

First, take the cut-off point. The cut-off point is at what frequency the wave has already been attenuated (reduced in amplitude) by 20% (Grass EEG) or 30% (Beckman EEG). The cut-off point is usually the dial setting on the low-frequency filter (Hz).



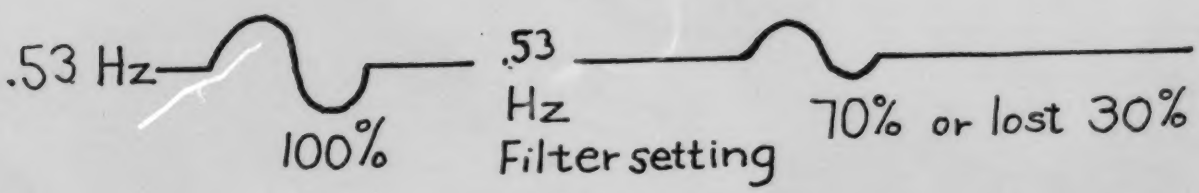
The above dial on the Grass EEG is on "1." This tells you that a 1 Hz wave will lose 20% of its amplitude or voltage from the electrodes as it is filtered to the pens or output.

The Beckman EEG has a dial that shows cut-off point, Hz, and the time constant - Sec.



BECKMAN EEG

The Beckman dial is on .53 Hz. This tells you that a .5 or a wave near this half a cycle per second would lose 30% of its initial voltage (amplitude).



QUESTIONS: (Encircle correct letter or letters.)

2. The cut-off point is the unit of the low frequency filter that tells when the EEG waves:

   a. are added to.

   b. are first attenuated.

   c. have already been attenuated a certain percentage.

3. At the cut-off point of the Grass EEG the wave is attenuated:

   a. 80%

   b. 60%

   c. 20%

   d. 30%

4. At the cut-off point of the Backman EEG the wave is attenuated:

   a. 60%

   b. 70%

   c. 30%

   d. 80%

2. You are right -- the first answer is __c__. The cut-off point is the frequency at which the wave has already lost or has been attenuated 20% or 30%.

3. The Grass EEG attenuates the waves at the cut-off point 20%, so the answer is __c__.

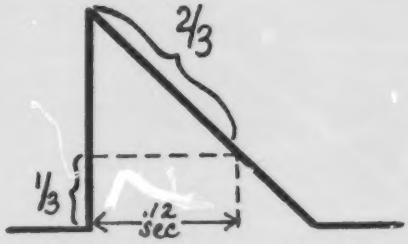
4. The Beckman EEG attenuates the waves at the cut-off point 30%, so the answer is __c__ .

Now let's learn what the time constant is.

Let us look at the time constant (TC). This tells you more about the low frequency filter. Each setting on the low frequency filter has a cut-off point and a time constant. The time constant is the time it takes, in seconds, for a square wave to decay (drop back) to 33% (one-third) of its initial amplitude.

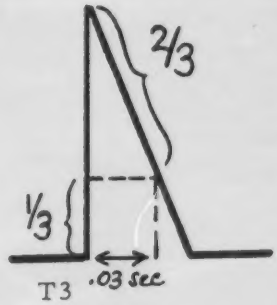
SQUARE WAVE

fig. 1



T. C.

fig. 2



T3

fig. 3

This unit is reflected on the calibration signal. (See above.) Figure 2 is a slower time constant than Figure 3. It takes more time to drop back to one-third of the initial amplitude. (This could also be described as two-thirds, or 67% from top of the square wave.) How to measure a time constant will be given in another unit.

QUESTION: (Encircle the correct letter or letters)

5. The time constant is the unit of the low frequency filter that gives the time it takes a square calibration wave to decay to:

   a. one-third of the initial amplitude.

   b. two-thirds of the initial amplitude.

   c. one-half of the initial amplitude.

   d. one-fourth of the initial amplitude

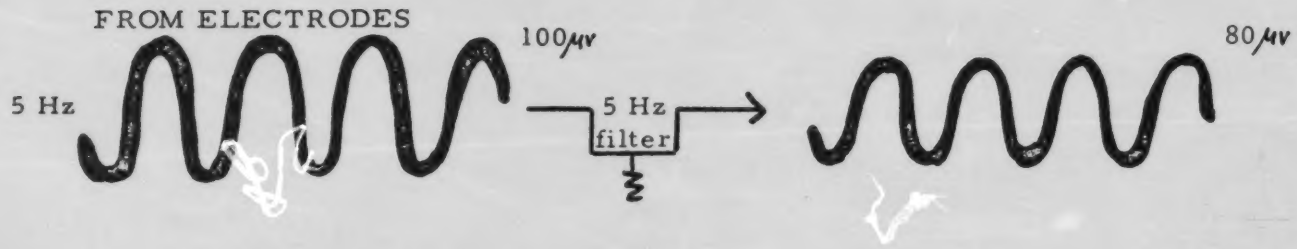
5. The answer is __a__ . The time constant is the time it takes the square wave to decay (drop) to 33% or one-third of its initial amplitude. This could also be said the drop of two-thirds of the way from the top of the square wave. Remember, this is either two-thirds from top or one-third of the initial amplitude.

The wave seen at the electrodes is a wave with two dimensions. Frequency in hertz and the amplitude which is figured in microvolts (μv). When this wave is filtered it is the amplitude, or μv, that is attenuated. You know the units of the low-frequency filter -- now you will see how the input from the electrodes is affected by this filter.

The Grass EEG Low Frequency Filter:

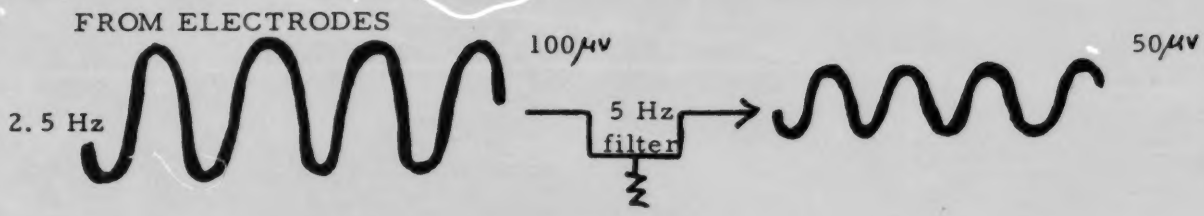
A. A wave with the same frequency of the dial setting (cut-off point) will be attenuated 20% so that 80% is seen at the pens or output. This was stated before -- here is an example of this:

> A brain wave 5 Hz, 100 μv, filtered by a 5 Hz filter would be seen as an 80 μv wave at the pens. (80% of 100 μv.)



B. Now if the wave were about one-half the frequency of the filter setting (cut-off point) only about one-half of the wave from the brain would be seen. For example:

> A 2.5 Hz, 100 μv wave filtered by a 5 Hz filter would be 50 μv at the pens. You would figure this: one-half the 5 Hz filter, or 2.5 Hz, gives one-half the original wave. (One-half of 100 μv = 50 μv.)



This is not the complete engineering formula. As technologist you must know what is happening, but you don't need the exact complicated formula. This means all those waves around half the filter setting (cut-off point) would be attenuated to about half the strength of the waves from the electrodes

C. Frequencies faster than the filter setting (cut-off point) are attenuated minimally and those faster (higher) than 12 Hz are not affected at all.

QUESTION: See if you can figure what happens to the wave from the brain, at the electrodes, when the different low frequency filters are dialed.

6. FILL IN THE BLANKS:

	WAVES FROM BRAIN		FILTER SETTING	PERCENT LOST	VOLTAGE AT PENS
	Hz	µv			
1)	1 Hz	50 µv	1 Hz	_____	_____
2)	.3 Hz	100 µv	.3 Hz	_____	_____
3)	20 Hz	80 µv	5 Hz	_____	_____
4)	2.5 Hz	80 µv	5 Hz	_____	_____
5)	.5 Hz	100 µv	1 Hz	_____	_____
6)	.15 Hz	20 µv	.3 Hz	_____	_____
7)	15 Hz	60 µv	1 Hz	_____	_____
8)	5 Hz	100 µv	5 Hz	_____	_____

See how well you did! The answers are on the next page.

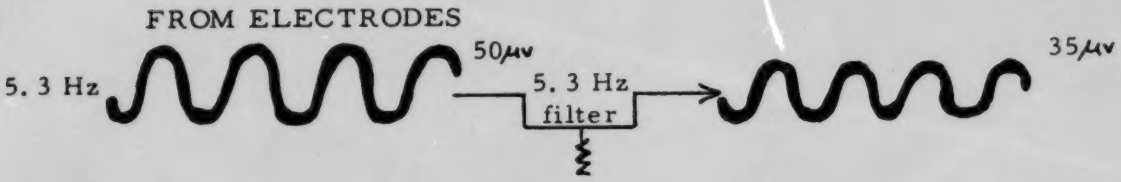
	PERCENT LOST	VOLTAGE AT PENS
1)	20%	40 μv
2)	20%	80 μv
3)	none	80 μv
4)	50%	40 μv
5)	50%	50 μv
6)	50%	10 μv
7)	none	60 μv
8)	20%	80 μv

Now that you understand the Grass low-frequency filter, go on to the Beckman EEG low-frequency filter. The electronics are a little different.

The Beckman EEG Low-Frequency Filter

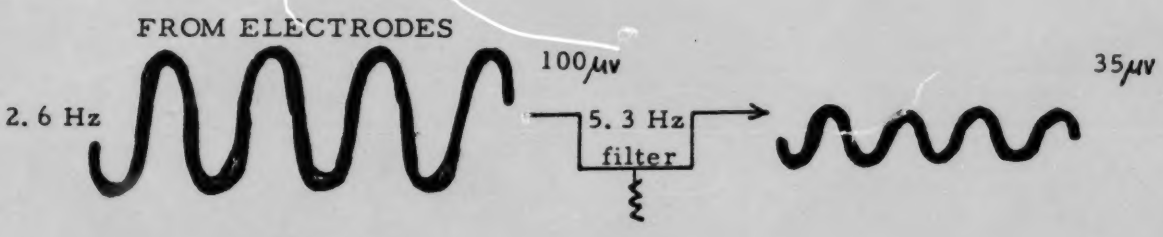
A. The frequencies at the dial settings (cut-off point) are attenuated 30%. This was said before, and an example of this is:

> The brain wave whole frequency and voltage is 5.3 Hz and 50 μv. Filtered by a 5.3 Hz filter it will produce 35 μv at the pens or output. This 50 μv wave has lost 30% or 15 μv, therefore 70% or 35 μv remains.



B. When the wave's frequency is slowed to one-half of the filter setting (cut-off point) only one half of what we would have seen at the filter setting will be at the pens. For example:

> The wave from the electrodes is 2.6 Hz, 100 μv, and the filter setting (cut-off point) is 5.3 Hz. This can be figured two ways.



a. The 100 μv wave would be reduced to 70 μv if the wave was 5.3 (70% of 100 μv) but the wave is half the filter setting so the output at the pens would be half the 70 μv or 35 μv.

b. Or, figured this way: At the cut-off point the wave would be 70% of the wave from the brain and at half the setting the output would be half of the 70% or 35% of the 100μv wave = 35 μv. So, you can say that when the wave is half the Hz of the cut-off point you get 35% at the pens, or lose 65% of the wave from the electrodes.

C. Frequencies faster (higher) than the cut-off point (filter setting) are attenuated minimally and those faster than 11 Hz are not affected at all by the low-frequency filter.

QUESTIONS:

7. Fill in Blanks:

	WAVES FROM ELECTRODES		CUT OFF POINT FILTER SETTING	PERCENT LOST	VOLTAGE AT PENS
	Hz	uv			
1)	13 Hz	100 µv	5.3 Hz	_____	_____
2)	5.3 Hz	100 µv	5.3 Hz	_____	_____
3)	2.6 Hz	50 µv	5.3 Hz	_____	_____
4)	1.6 Hz	35 µv	1.6 Hz	_____	_____
5)	16 Hz	75 µv	1.6 Hz	_____	_____
6)	15 Hz	150 µv	.53 Hz	_____	_____
7)	.5 Hz	20 µv	.53 Hz	_____	_____

Now see how many you got right!

	PERCENTAGE LOST	VOLTAGE AT PENS
1)	none	100.0 μv
2)	30%	70.0 μv
3)	65%	17.5 μv
4)	30%	24.5 μv
5)	none	75.0 μv
6)	none	150.0 μv
7)	30%	14.0 μv

POST-TEST

Encircle the correct answer:

1. The low-frequency filter affects the:
   a. 15 to 35 Hz. waves
   b. D.C. and 0 to 12 Hz A.C. waves
   c. the high frequencies
   d. 5 to 15 Hz signals

2. The time constant is the time it takes for the square wave to:
   a. decay to 35% (one-third) of its initial amplitude
   b. drop one third of its amplitude
   c. rise two-thirds of the way up the signal
   d. drop one-half of the initial amplitude

3. The time constant is calculated in:
   a. minutes
   b. seconds
   c. frequency
   d. Hz.

4. The cut-off point is where the wave:
   a. begins to lose amplitude
   b. has already been attenuated a percentage
   c. has lost 80% or 70% of the amplitude
   d. has been attenuated 20% or 30% of the waves

Fill in the Blanks:

	BECKMAN EEG WAVE		CUT OFF POINT	VOLTAGE AT PENS
5.	15 Hz	150 uv	1.6 Hz	_____
6.	.26 Hz	200 uv	.53 Hz	_____
7.	.16 Hz	50 uv	.16 Hz	_____
8.	5.3 Hz	100 uv	5.3 Hz	_____
9.	2.6 Hz	100 uv	5.3 Hz	_____

	GRASS EEG WAVE			
10.	1 Hz	200 uv	1 Hz	_____
11.	.15 Hz	100 uv	.3 Hz	_____
12.	2.5 Hz	150 uv	5 Hz	_____
13.	.1 Hz	100 uv	.1 Hz	_____
14.	1 Hz	50 uv	1 Hz	_____

15. Determining the effect of the low frequency filter on the EEg waves is now:

    a. very clear c. slightly unclear

    b. clear d. unclear

16. Could you confidently explain how to calculate the voltage of a wave filtered by the low frequency filter of either the Grass EEG or the Beckman EEG to another student?

    _____YES _____NO

POST-TEST ANSWERS

1. b
2. a
3. b
4. b

Beckman

5. 150 µv
6. 70 µv
7. 35 µv
8. 70 µv
9. 35 µv

Grass

10. 160 µv
11. 50 µv
12. 75 µv
13. 80 µv
14. 40 µv

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RIGHT LATERAL DECUBITUS

POSITION - WHAT VIEW IS IT?

By

Mary G. Watts

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TITLE OF PACKAGE:	Right Lateral Decubitus Position - What View Is It?
AUTHOR:	Mary G. Watts
INSTITUTION:	El Centro College
INTENDED STUDENTS:	Radiologic Technology Students
ESTIMATED WORKING TIME:	30 Minutes
MATERIALS NEEDED:	Optional - X-ray films: AP, PA View, Upright PA View, AP View, Right Lateral Decubitus

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OBJECTIVES OF UNIT

Overall Objective

When viewing a radiograph taken in the right lateral decubitus position, the student will determine the position of the patient, Cassette and direction of the x-ray beam in order to determine the view obtained on the film.

Sub-Objectives

1. Define the terms decubitus and right lateral decubitus.
2. Describe the patient conditions which might require a right lateral decubitus.
3. Determine the position of the patient, cassette and x-ray table or stretcher.
4. Determine how the C.R. is directed to the body part and cassette and what view is obtained for a lateral decubitus position.
5. Determine the position of the patient, cassette and C.R. when viewing the film obtained with the patient in the right lateral decubitus position.

INTRODUCTION

It is important when you are looking at a radiograph to determine the position the patient was in when the film was taken. Equally important is to have a good understanding of the relationship of the cassette to the part of interest. The direction of the central x-ray beam and its relationship to the patient and cassette is very important also since it will dictate what view has been obtained on the radiograph. The skill of evaluating films and perceiving patient's position will enable you to readily see the view you have obtained on the film.

This package is designed to enable you to determine the patient position, relationship of the cassette and C.R. each time you want to figure out the view obtained when doing a right lateral decubitus position.

PRACTICE EXERCISE #1

Input

You are going to be learning how an A.P. view is obtained when positioning a patient in the right lateral decubitus position.

The term "decubitus" means the act of and the position assumed in lying down. The position is described according to the dependent surface: e.g. eight lateral decubitus, lying on the right side. In this instance the right side is the dependent side since the patient is lying on his right side. The term "right lateral decubitus" is used in radiography to specify the position of the body for horizontal ray projections. Consider this illustration.

RIGHT LATERAL DECUBITUS

Practice Question #1

See if you understand the above definitions for decubitus and right lateral decubitus by restating them in your own words.

Decubitus _____

Right Lateral Decubitus _____

Check your answers on the next page.

Feedback

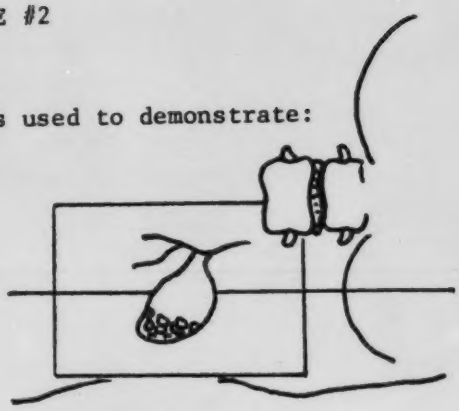
If you answered that decubitus means lying down and that right lateral decubitus means lying on the right side, you have answered correctly.

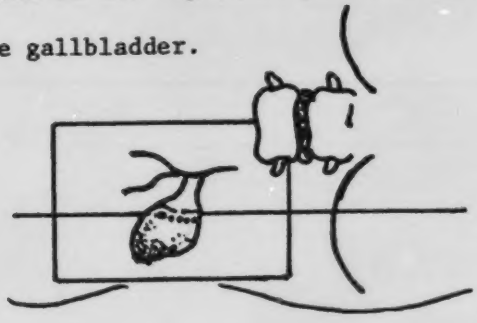
PRACTICE EXERCISE #2

Input

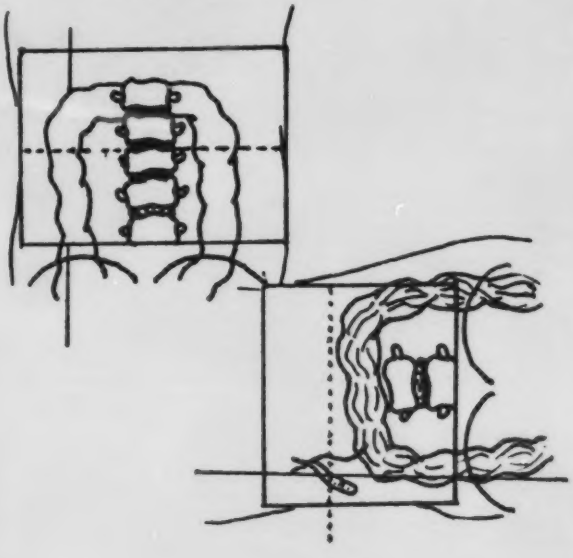
The right lateral decubitus position is used to demonstrate:

1) Gallbladder stones that are heavier than bile and that are too small to be visible other than when accumulated in the dependent position of the gallbladder.

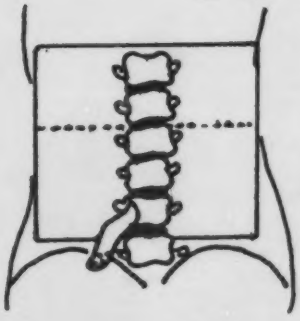


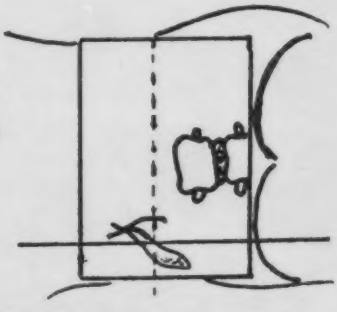


2) Stones that are lighter than bile and that are visualized only by stratification (layering out).



3) This position has the further advantage of permitting the gall bladder to gravitate toward the dependent right side, where it will lie below any adjacent gas - containing loops of the intestine and.....





...4) away from bony superimposition when it occupies a low and/or medial position.

Practice Question #2

After studying the illustrations see if you can answer the following:

1) When doing a right lateral decubitus position during a gallbladder X-ray examination, the gall stones layer out or _____.

2) Gall bladder calculi stratify or layer out because _____ _____

3) What happens to the gallbladder when the patient lies on his right side?

Check your answers on the next page.

Feedback

When doing a right lateral decubitus position during a gallbladder X-ray examination, the gall stones layer out or stratify.

Gall bladder calculi stratify or layer out because of the composition and weight of the stones.

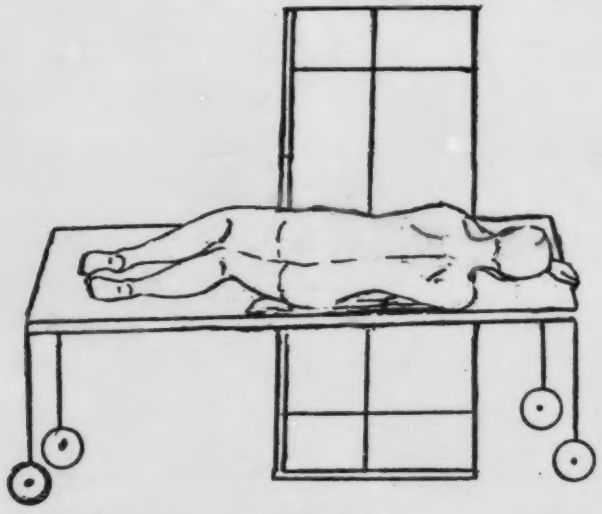
The gallbladder gravitates or moves toward the dependent right side when the patient lies on his right side.

If you answered correctly, you did great! Continue on.

EXERCISE #3

Input

The patient is placed on his or her right side or in the right lateral decubitus position lying on a stretcher or a moveable table before a vertical Potter-Bucky diaphragm with the cassette in the film tray. Since the gallbladder is located in the anterior portion of the right upper quadrant, the film is placed adjacent to the anterior abdomen. The patient may be positioned on the X-ray table lying on his right side and with a grid cassette positioned against the anterior abdomen. Consider these illustrations:



Practice Question #3

1) Since the gallbladder lies on the right upper quadrant and the goal is to project the gallbladder away from the super-imposing organs, the position of the patient which would move the gallbladder towards the lateral portion of the abdomen would be the _____, _____ _____.

2) Since the gallbladder is more anterior than posterior, the cassette is placed _____

3) If the moveable grid in the X-ray table is not utilized during exposure, a _____ cassette must be used.

Check your answers on the following page.

Feedback

Since the gallbladder lies on the right upper quadrant and the goal is to project the gallbladder away from the super-imposing organs the position of the patient which would move the gallbladder towards the lateral portion of the abdomen would be the right lateral decubitus.

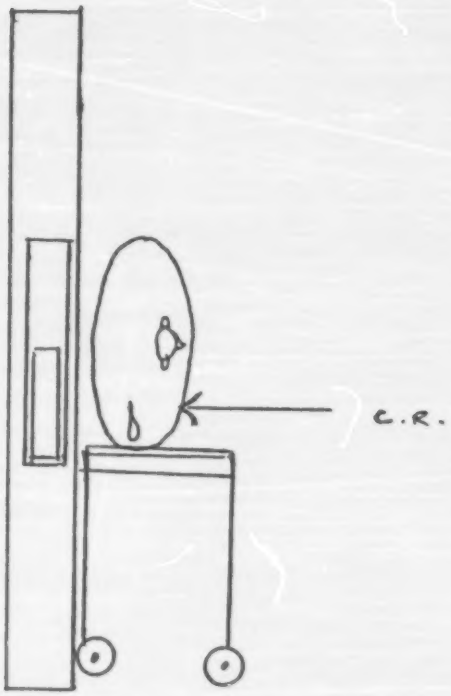
Since the gallbladder is more anterior than posterior, the cassette is placed adjacent to the anterior abdomen.

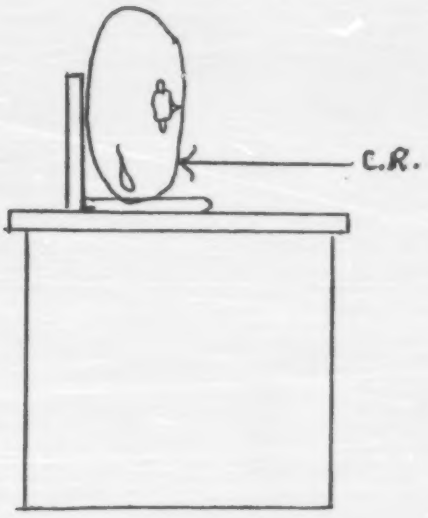
If the moveable grid in the X-ray table is not utilized during exposure, a grid cassette must be used.

PRACTICE EXERCISE #4

Input

When the patient is positioned in the right lateral decubitus position on the horizontal X-ray table or horizontal stretcher, the cassette is always vertical to the stretcher or X-ray table and parallel to the right upper quadrant. The right upper quadrant is projected posterior to anterior to the cassette. Note that the central ray enters at the posterior portion of the right upper quadrant and exists anteriorly. Thus if the C.R. enters posteriorly and exists anteriorly this is a PA projection of the right upper quadrant which results in an AP (Anterior to posterior) view of the right upper quadrant since the best detail on the film will be that of the parts closest to the film, in this case the anterior upper right quadrant of the abdomen. Consider the illustrations:





EXERCISE #4

Practice Questions #4

1) If the anterior surface of the right upper quadrant is adjacent to the cassette, the C.R. enters at _____

2) When directing the C.R. towards the cassette, the relationship of the C.R. to the horizontal X-ray table or stretcher is _____ or _____ to each other.

3) When directing the C.R. towards the certical cassette, the relationship of the C.R. to the cassette is _____ to each other.

4) When directing the C.R. towards the cassette, the relationship of the C.R. to the right upper quadrant is _____ or _____ to each other.

5) If the right lateral decubitus results in a PA projection of the right upper quadrant, the resulting view on the radiograph will be a (an) _____ view.

Check your answers on the following page.

Feedback

If the anterior surface of the right upper quadrant is adjacent to the cassette, the C.R. enters at posterior portion of the right upper quadrant.

When directing the C.R. towards the cassette, the relationship of the C.R. to the horizontal X-ray table or stretcher is parallel.

When directing the C.R. towards the vertical cassette, the relationship of the C.R. to the cassette is perpendicular.

When directing the C.R. towards the cassette, the relationship of the C.R. to the right upper quadrant is at right angles.

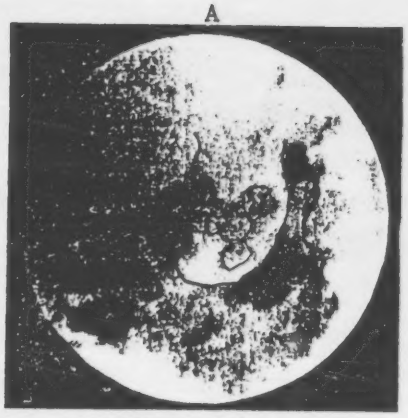
If the right lateral decubitus results in a PA projection of the right upper quadrant, the resulting view on the radiograph will be an AP view.

PRACTICE EXERCISE #5

Input

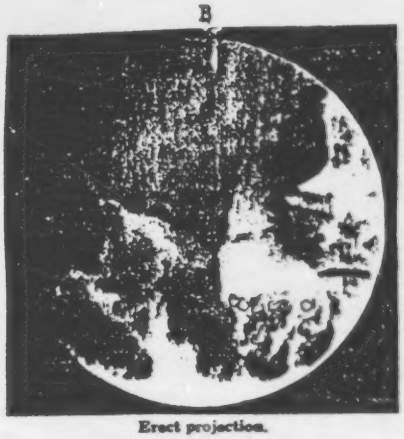
When viewing the film obtained with the patient in the right lateral position you will note that you are looking at a frontal or AP view of the right upper quadrant. Remember that the right upper quadrant was adjacent to the vertical cassette and that the C.R. transversed the right upper quadrant horizontally from posterior to anterior. So the resulting view has to be a frontal view. (Do not assume that because the patient is lateral that the view obtained will also be lateral. Remember the C.R. is directed horizontal thru the right upper quadrant. For a lateral view the CR would have to be directed vertically through both the right and left upper quadrants). Consider the following illustrations :

A



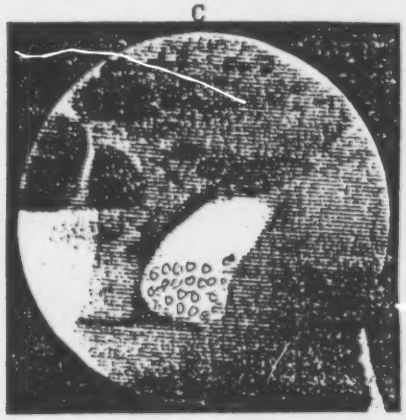
Prone projection.

B



Erect projection.

C



Decubitus projection on above patient.

PRACTICE EXERCISE #5 (Cont.)

Practice Question #5

1) When the patient is lying on his right side and the film is placed adjacent to the anterior right upper quadrant and the C.R. is directed horizontally to enter at the posterior portion, the view obtained is a (an) _____.

2) Which of the three films on Page 14 is an A.P. view of the gallbaldder taken with a horizontal C.R.?

A B or C

Check your answers on the following page.

EXERCISE #5

Feedback

When the patient is lying on his right side and the film is placed adjacent to the anterior right upper quadrant and the C.R. is directed horizontally to enter at the posterior portion, the view obtained is an AP.

Film #C on the Page 14 is an AP view of the gallbladder taken with a horizontal C.R.

POST-TEST

1a. A patient who is said to be in the decubitus position would be:

1) Seated
2) Erect
3) Lying down
4) Semierect

1b. A patient positioned in the right lateral position would be lying on his:

1) Stomach
2) Left side
3) back
4) right side

1c. The dependent side on the right lateral decubitus position is the _____ side.

2a. The right lateral decubitus position is used to demonstrate _____

2b. Gall bladder calculi stratify (layer out) because _____ _____.

2c. What happens to the gallbladder when the patient lies on his right side?

2d. What happens to the stones when the patient lies on his right side?

3a. In order to demonstrate stratification of biliary calculi, the patient would be asked to lie down on his _____ _____.

3b. For a right lateral decubitus position, the cassette is placed adjacent to the patient's

1) Abdomen
2) Right side
3) left side
4) back

3c. If the upright bucky or table is not used a _____ cassette must be utilized when doing a lateral decubitus.

4a. When doing a right lateral decubitus, the C.R. enters at the

1) anterior abdomen
2) posterior abdomen
3) right side
4) left side

4b. The C.R. is directed _____ to the horizontal table
1) parallel 3) horizontal
2) diagonally 4) 1 and 3

4c. The C.R. is directed _____ to the vertical cassette.
1) parallel 3) horizontal
2) perpendicularily 4) diagonally

4d. The C.R. is directed _____ to the right upper quadrant
1) at right angles 3) horizontal
2) perpendicular 4) 1 and 2

5a. Determine what view is obtained on the radiography when the patient is on the right lateral decubitus position.

5b. Distinguish which of the following radiographs is the AP view of the right upper quadrant.

A

B

C

POST TEST KEY

1a. 3

1b. 4

1c. right

2a. stratification of Gallbladder calculi

2b. of the weight or composition of the stones

2c. the gallbladder moves to the right lateral side of the abdomen.

2d. The stones layer out according to their weight in the fundus of of the gallbladder.

3a. right side

3b. 1

3c. grid

4a. 2

4b. 1 and 3

4c. 2

4d. 1 and 2

5a. AP view of right upper quadrant

5b. B

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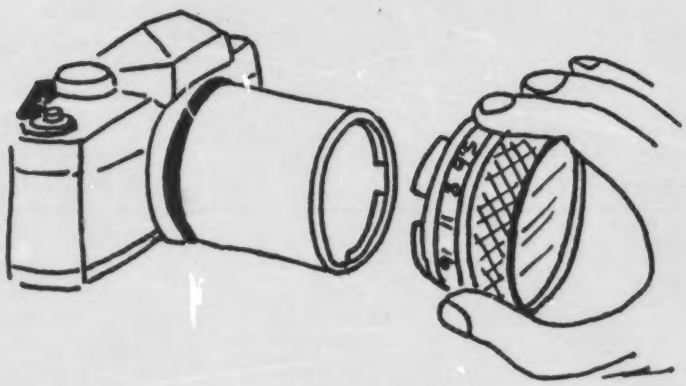
"CLOSE-UP PHOTOGRAPHY USING EXTENSION TUBES"

By

Stephen K. Peltz



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TITLE OF PACKAGE:	Close-Up Photography Using Extension Tubes
AUTHOR:	Stephen K. Peltz
INSTITUTION:	West Valley College, Saratoga, Calif.
INTENDED STUDENTS:	Biomedical photography
ESTIMATED WORKING TIME:	30 minutes
MATERIALS NEEDED:	Single lens reflex camera with normal lens; photo beanbag or tripod; extension tubes; work-table; carousel slide projector; carousel of 10 black-and-white slides to evaluate (divided into Group A and Group B - 5 slides each group)

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CLOSE-UP PHOTOGRAPHY USING EXTENSION TUBES

Introduction:

Most people like photographs that show things we cannot see with the naked eye. The use of extension tubes as a close-up accessory allows for much more dramatic and exciting pictures than normal focusing ranges can provide because you can focus about two inches from your subject. This capability will allow you to photograph very small objects and still "fill" your viewfinder. Once you get into the world of close-up photography, you'll find that you not only start seeing the world differently but close-ups will be one of your favorite photographic avenues.

Objectives:

Overall objective: student will use a single lens reflex as a close-up camera by attaching a set of extension tubes, demonstrate their use and calculate exposure.

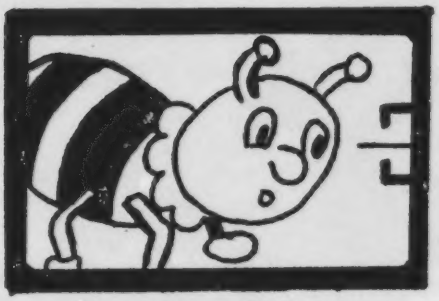
Sub-objectives:

1. Define the terms close-up photography, macro photography and micro photography.
2. List the advantages and disadvantages of using extension tubes.
3. Given a single lens reflex camera, attach a set of extension tubes to the camera so that the lens, camera, and tubes are snug and secure.
4. Given a single lens reflex camera, demonstrate the use of the extension tubes by steadying the camera and focusing on a given subject at the maximum magnification using the camera's focusing screen and the focusing criteria outlined in the instructional package.
5. Given a set of extension tubes attached to the camera and at maximum magnification, calculate the final exposure to be used.
6. Evaluate 10 slides according to the criteria outlined in the instructional package.

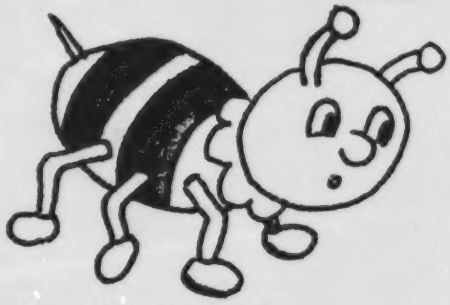
Close-up photography may be defined as the technique of photographing closer than the normal closest focusing range of a given lens but less than 1:1 magnification.

Macro photography is simply photography done at a 1:1 magnification or better. Macro photography may also be termed photomacrography.

Micro photography is taking photographs through a microscope.



Camera Viewfinder



Actual Size

MAGNIFICATION OF 1:1 (LIFE SIZE)

Practice Question 1

See if you understand the above definitions by stating in your own words what is meant by the following terms.

a. Macro photography _____

_____

b. Close-up photography _____

_____

c. Micro photography _____

_____

You are correct if you answered:

Macro photography - photos taken at 1:1 magnification or better

Close-up photography - photos taken at a closer distance than the normal closest focusing range of a lens, but less than 1:1 magnification.

Micro photography - photos taken through a microscope.

The use of extension tubes as a close-up or macro accessory has the following advantages and disadvantages:

Advantages:
a. can attain magnifications up to 2:1 (twice lifesize).
b. can be attached to almost every single lens reflex camera.
c. inexpensive ($15-$45 depending on camera).

Disadvantages: loss of light results; therefore, must correct exposure by opening aperture or slower shutter speed.

Practice Question #2:

Now list the advantages and disadvantages of using extension tubes as a close-up attachment.

a. Advantages: _____

_____

_____

b. Disadvantages: _____

_____

Answer: The advantages are magnification up to 2:1;
cant fit almost every SLR;
Disadvantage is light loss; so exposure compensation is necessary.

An extension tube is simply a tube that fits between the camera body and the lens. The extension tubes must be attached to the camera so that the camera, lens and tubes become one solid piece of equipment. Use the check list below to insure a secure installation when you put on your tubes.

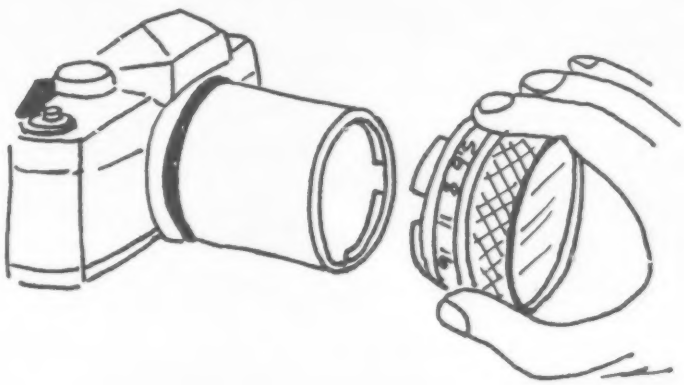
CHECK LIST

a. Remove lens from the camera body in normal manner. The lens will either screw off in a counterclockwise direction, or if it is a "bayonet" mounted lens, it can be removed by pushing a release button and turning the lens 1/4 turn counterclockwise. Refer to your camera instruction manual if you have problems.

b. Attach one or more of the extension tubes to the camera body by aligning the red dots on the tubes and camera body and twisting clockwise as far as you can. If a threaded mount, simply screw the tubes into the camera body.

c. Attach the lens to the open end of the extension tubes in like manner as above.

d. Twist lens and tubes counterclockwise without pushing the release button to insure a secure and tight fit. Thre should be no play in the attached pieces equipment.



Practice Question #3

Using the camera, lens and extension tubes, attach the tubes to the camera body and then the lens to the extension tubes so that the finished piece of equipment will be snug and secure.

You performed this activity correctly if you:

a. removed the lens from the camera body.

b. attached one or more of the tubes to the camera body and secured it (them).

c. attached the lens to the open end of the extension tube and secured it.

d. tested for tightness by twisting counterclockwise and checking for play.

The greater the distance or more extension placed between the lens and camera body, the greater the magnification. Greater magnifications require the camera be held very steady and focused precisely. Steadying of the camera is best done with a tripod attached to the camera or setting the camera onto a beanbag. Beanbags are useful for close to the ground work.

To. focus your camera use the following criteria:

a. Focus first by moving camera back and forth to "get close."

b. Then use focusing ring on lens to sharpen image on the camera's viewing screen.

c. Focus on what you feel is the most important part of your subject. Such as the eyes, etc.

d. Focus on lines or edges and turn focusing ring to get sharp, clean edges. Blurred edges are not in focus.

3. Use microprism or split image area of focusing screen for most accurate focus.

f. Now stop down lens and check for depth of field desired. Sometimes the background dictates the aperture you will use, but usually the lens must be stopped to f 16 or f 22 as depth of field is very shallow at close magnification. Leave lens stopped down to take final picture.

Practice Question #4

Using the camera, lens and extension tubes, steady the camera by placing it on a tripod or beanbag and focus on the subject according to the focusing criteria outlined on the previous page.

You performed admirably if you:

a. used the microprism or split image part of your focusing screen.

b. used the focusing ring on the lens for critical focus.

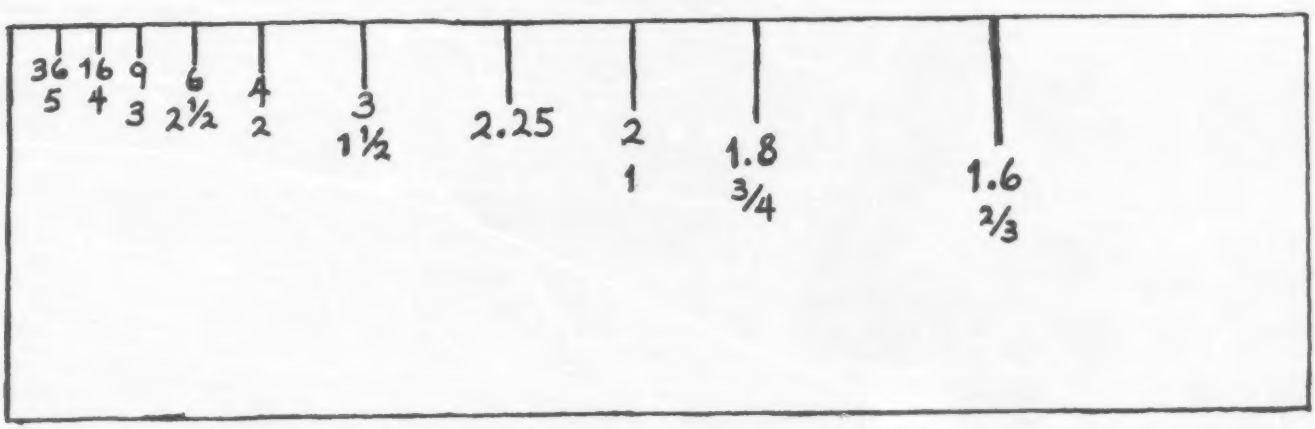
c. focused on most important part of subject such as the eyes.

d. got sharp edge lines

e. stopped down lens to check depth of field and background.

Because extension tubes increase the distance between the lens and the camera, a light loss results. There is more light lost as the distance between the lens and the camera increases. Losing all this light would result in underexposure if you didn't do something to make up for it. You have to compensate for the light loss with an adjustment in the exposure which can be found by using a MAGNIFICATION/CORRECTION chart. To calculate the correct exposure, use the magnification chart to get a multiplication factor. This factor is used to change the shutter <u>speed</u> to compensate for the light loss.

CLOSE-UP CORRECTION SCALE FOR 35mm CAMERAS



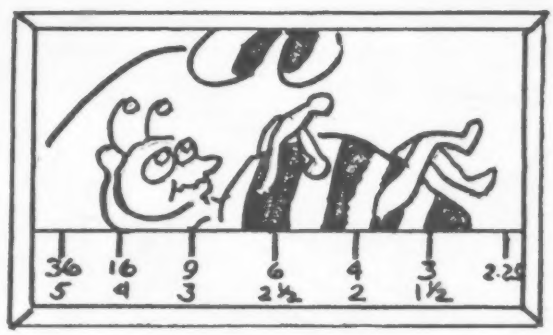
upper scale: multiplication factors for exposure time

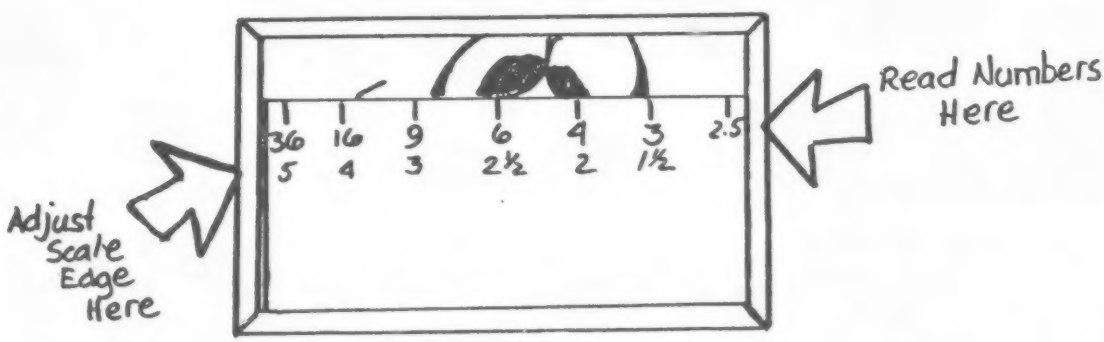
lower scale: number of f stops to open up

To use this close-up correctionscale, focus your close-up picture.

Hold this scale parallel to the film plane, as it runs across the inside of the camera, and directly <u>on</u> the subject. It works easier if the scale is mounted on cardboard.

Adjust the scale so the left hand edge is lined up with the left side of the viewfinder. Read the numbers nearest to the right side of the viewfinder. To correct exposure by changing the shutter speed, multiply the exposure time indicated by your light meter by the upper number on the scale. To change the f stop, open up the aperture the number of stops shown by the lower numbers.





For instance, seeing the number 2 on the upper scale at the viewfinders' right edge when the left edges of the focusing screen and the left line and the chart match up, means you need 2X more exposure. An original exposure then of 1/125 @ f 16 (read with a light meter in the normal way) would become 1/60 @ f 16 which is two times the original exposure. (It lets twice as much light in to make up for that light loss.) It is best to change the shutter speed to compensate, rather than the aperture, as you don't want to change your depth of field. In this package, always change the shutter speed.

(NOTE: A through-the-lens meter automatically compensates for the light loss and you don't need to use the chart or calculate an exposure change.)

Practice #5A

Using the magnification chart, attach all three extension tubes and find the multiplication factor between the camera and lens. Then using the original exposure of 1/30 sec @ f 11, calculate the new exposure. (magnification/correction chart on page 7.)

Answer: The extension tubes used in preparing this package indicated a new exposure should be 1/8 sec @ f 11 as the multiplication factor was 4 or 4X the original exposure. The tubes you are using should be very close. Did you remember to change the shutter speed instead of the aperture?

Now that you have used extension tubes on the camera to focus and compose a picture, let's see if you can apply this knowledge in evaluating some slides taken with extension tubes.

Practice #5B

Analyze the five Group A slides provided for evaluation, using the following criteria:

a. approximate magnification
b. exposure (over or under exposed)
c. focus
d. depth of field (adequate or not)
e. background (distracting?)

You are the judge as to the correctness of your evaluation and the degree of confidence you feel. If you have any doubts, review the previous exercises before continuing on to the Post-Test.

Post-Test

1. Match the following terms and definitions:

   _____ 1) Photographs taken through the microscope.

   _____ 2) Photographs taken at 1:1 magnification or better

   _____ 3) Photographs taken at closer distance than the normally closest focusing range of a lens but less than 1:1 magnifications.

   A. macro photography
   B. micro photography
   C. close-up photography

2. Describe the advantages and disadvantages of using extension tubes as a close-up attachment.

   a) Advantages: _____

   _____

   _____

   b) Disadvantages: _____

   _____

   _____

3. Demonstrate the ability to attach the extension tubes onto the camera and lens.

4. Demonstrate the camera focusing and steadying procedure using extension tubes and meeting the focus criteria outlined in the instructional package.

5. Calculate the final exposure when using extension tubes at maximum magnification and stopped down aperture. Straight meter reading is 1/125 @ f 16. Use the magnification chart to determine multiplication factor.

6. Evaluate each of the five slides in Group B, using the criteria below.

   a. Close-up accessory likely used.
   b. exposure (over or under exposed?)
   c. in or out of focus
   d. adequate depth of field
   e. Background (adequate or distracting)

ANSWER KEY FOR POST-TEST

1. 1) B

   2) A

   3) C

2. a) Magnification up to 2:1
   Fit almost al SLR's
   Fairly inexpensive

   b) Light loss so must compensate with exposure.

3. Your method should have included removing lens from camera, attaching tube(s) by twisting clockwise or screwing, attaching lens to end of tube(s), assuring tight fit by twisting counterclockwise.

4. You were in focus if you used the microprism or split image part of your focusing screen, used the focusing ring, focused on the subject's eyes or other important part, got sharp edge lines, and stopped the lens down to check depth of field and background. You used a tripod or beanbag to steady the camera.

5. Since the maximum mangification of the extension tubes used for this package indicated a multiplication factor of 4 or 4 times the original exposure, the new exposure should be 1/30 @ f 16

6. You may wish to check the accuracy of your evaluation with fellow students or instructors at this point.

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